Space Weather Technical Forecast

Issued on Saturday, 18 June 2022 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Daily chance of isolated M-class flares. Active (1e8 integrated pfu) fluence becoming likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with a few C-class flares, mostly originating from AR3030 and AR3031. There are currently 8 numbered sunspot regions plus two new regions on the visible disc. The largest and most complex has been AR3031 in the southwest, although it has been showing some decay in its intermediate spots. Two regions are showing signs of growth, AR3030 in the northwest and AR3038 in the northeast quadrant. All other spot groups are relatively simple, with some showing some minor decay.
No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, is indicative of a coronal hole high speed stream, although the source is a little uncertain. Wind speeds mostly fluctuated between 550-650km/s. Density was at mainly average levels. The IMF, Bt, was weak at 7nT or below, while the north-south component, Bz, fluctuated between +/-7nT. The phi angle was predominantly positive (away from the Sun), with some brief negative variations. Geomagnetic activity was Quiet to Unsettled (Kp 2 to 3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured by GOES16 has returned to background levels.
Electron flux (greater than 2MeV) peaked at moderate levels just shy of the High alert threshold, reaching 937 pfu at 17/1800 UTC. Corresponding 24-hour integrated electron fluence has been on a rising trend, reaching 2.7e7 integrated pfu at 18/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mostly Low with a chance of isolated M-class flares, and just a very slight chance of X-class flares, most likely from AR3030 and AR3031.

Solar Wind / Geomagnetic Activity: No CMEs are currently expected to affect Earth during the period.
Solar wind speeds are expected to remain largely elevated or perhaps strong over the next two to three days, due to coronal hole influences. Wind speeds should start to decline on Day 3 into Day 4 (20-21 June) as the coronal holes rotate away. Geomagnetic activity is expected to be mostly Quiet to Unsettled, but with a chance of an Active or even a very slight chance of a G1/Minor Storm interval on Days 1 and 2 (18-19 June). Geomagnetic activity becoming largely Quiet through Day 3 into Day 4.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at background levels during the period, but with a very slight chance of an S1 or greater event occurring due to the westward transit of AR3030 and AR3031.
High energy electron flux (greater than 2 MeV) is currently at moderate levels, but is likely to

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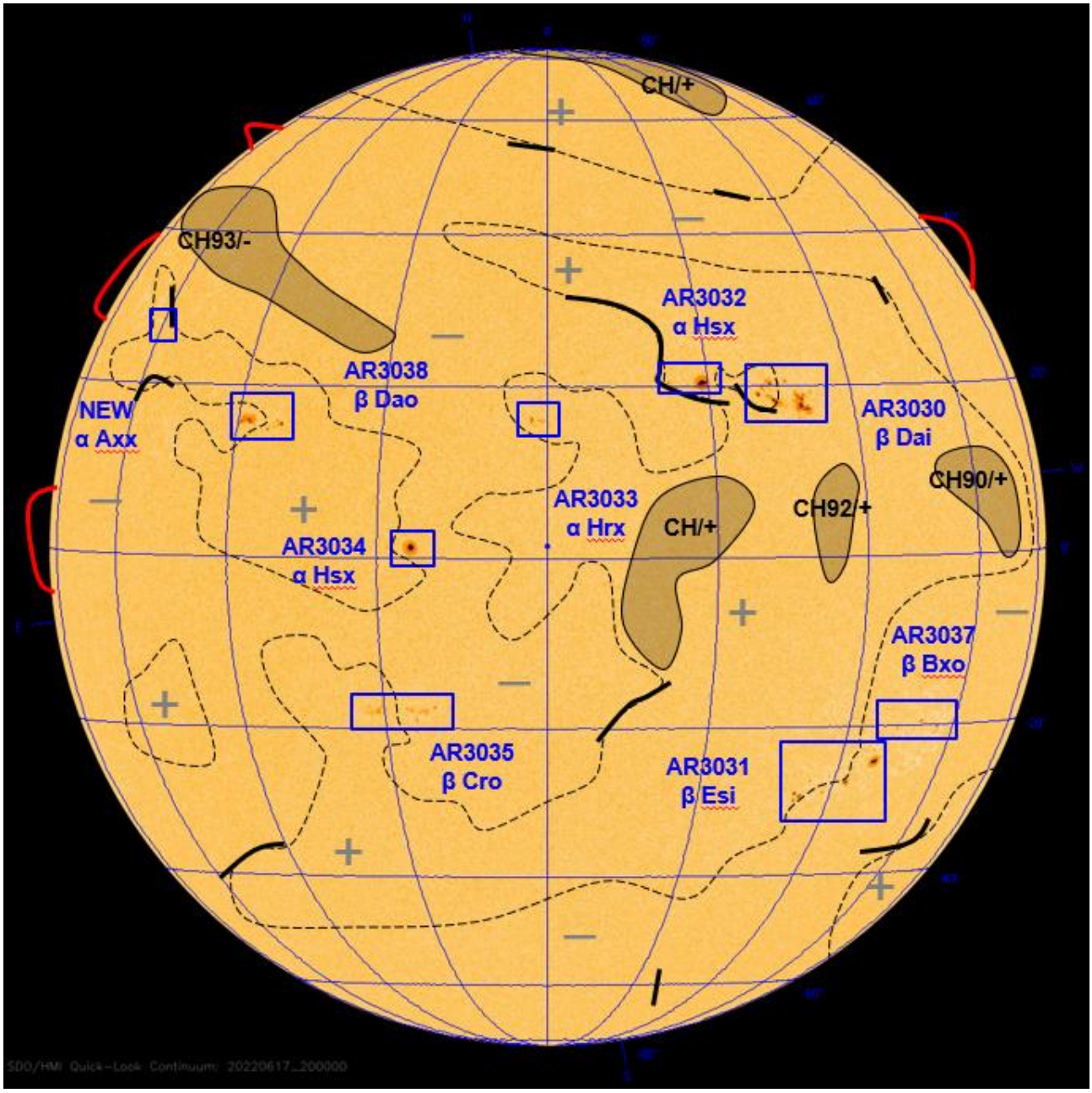
reach High (1000 pfu) levels at the diurnal peaks over the coming days. Electron fluence is expected to follow a rising trend, with Active (1e8 integrated pfu) levels becoming likely during the period.

Figure 1. Solar Analysis Valid 17/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No CMEs are currently expected to affect Earth during the period.
Solar wind speeds are expected to remain largely elevated or perhaps strong over the next two to three days, under the influence of CH90/+ and CH92/+, followed by a further weak unnumbered coronal hole. Wind speeds should start to decline on Day 3 into Day 4 (20-21 June) as these features rotate away from a geoeffective position.

Geomagnetic activity is expected to be mostly Quiet to Unsettled, but with a chance of an Active or even a very slight chance of a G1/Minor Storm interval on Days 1 and 2 (18-19 June), should we have a prolonged period of negative Bz. Geomagnetic activity becoming largely Quiet through Day 3 into Day 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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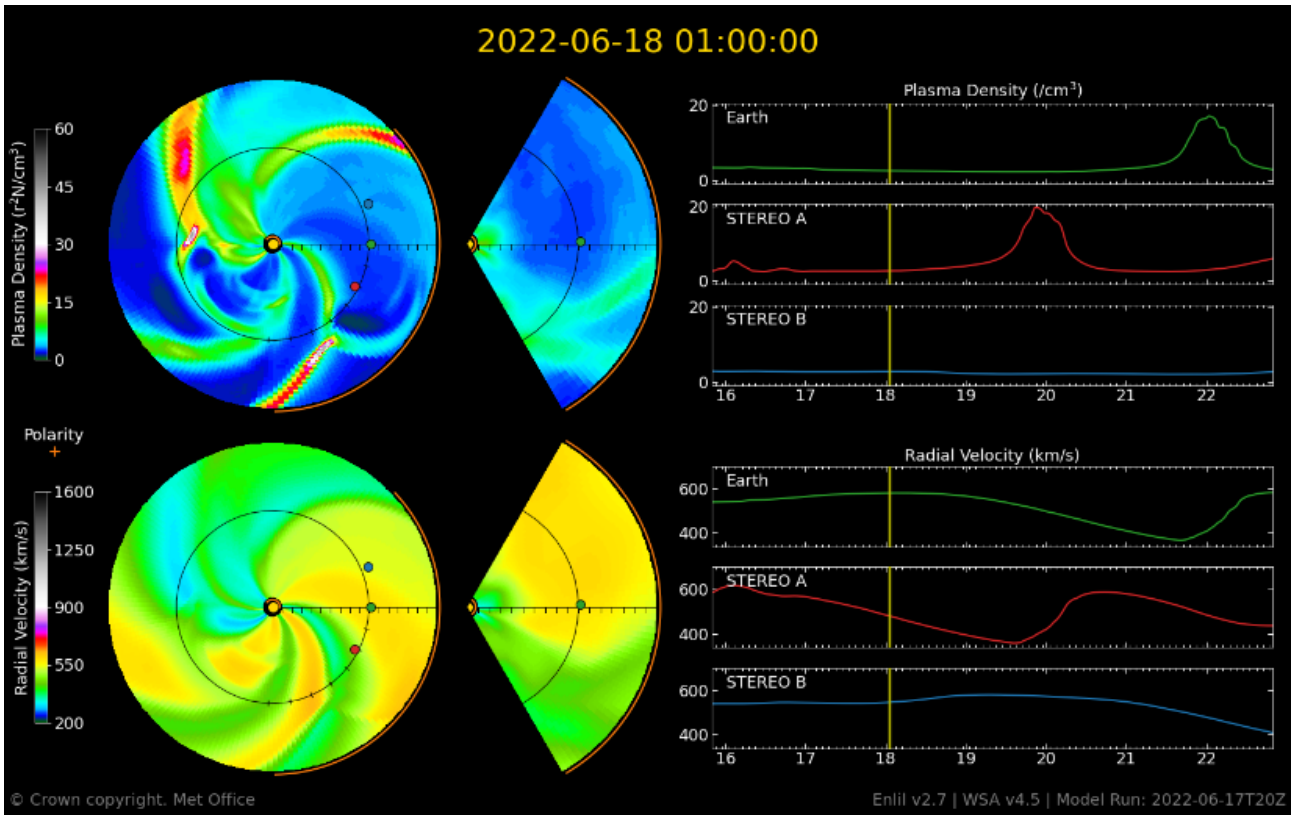
Figure 2: MOSWOC Enlil showing a gradual declining trend in wind speeds through Days 2 and 3, which may be a little too early.



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Radio Blackouts - X-Ray Flares:

There are currently 8 numbered sunspot regions and two new regions on the visible disc. AR3031 (Esi/Beta) in the southwest has been the most complex region. However, it has seen its complexity reduce, with some fading of intermediate spots. AR3030 (Dai/Beta) has recently grown, with significant increase in penumbral area, but retains a relatively simple magnetic structure at present. AR3038 (Dao/Beta) has also grown, with an increase in penumbra, especially on the trailing spot. All other spot groups are either unchanged in overall appearance, or showing some minor decay, and have relatively simple uni-polar or bi-polar magnetic configurations.

Despite the congested disc, X-ray flare activity has been limited, with only a few C-class flares, mainly from AR3030 and AR3031. Some brighter flux from over the east limb is currently visible on STEREO-A imagery, although it is currently unclear if this is likely to be from further sunspot regions or just areas of plage.

Overall, further C-class flares are expected with a chance of isolated M-class flares, and just a very slight chance of an X-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) has now returned to background levels following the M3 flare on the 13 June.

There is a slight chance of an S1 or greater event in the period, as a result of the westward transit of AR3030 and AR3031, which are the most likely sunspot groups of the current cohort to produce a significant flare and are now at favourable longitudes to give a proton enhancement at Earth.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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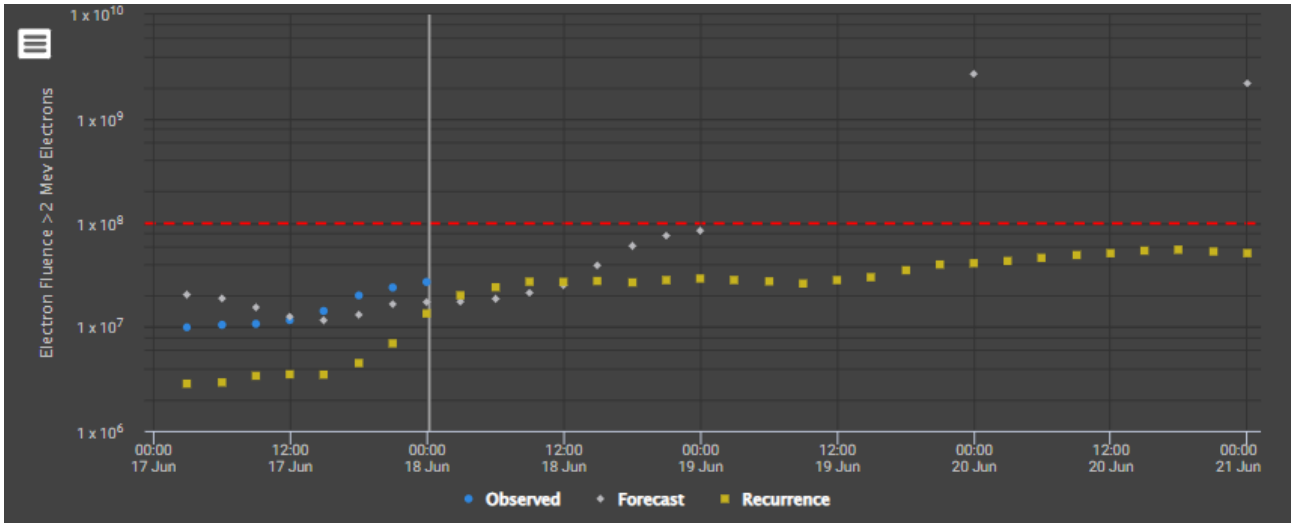
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as observed by GOES-16 is currently at Moderate levels, having peaked just shy of the High (1000 pfu) alert threshold. A further rising trend is expected in the coming few days given the current elevated to strong wind speeds, with these expected to continue through the next 2 to 3 days. Diurnal flux is likely to peak at High levels.

The corresponding electron fluence is expected to follow a rising trend, with exceedance of the Active (1e8 integrated pfu) threshold becoming likely during the period. The upward trend from MOSWOC REFM is reasonable, although the peak values on Days 2 and 3 (19-20 June) appear to be a significant overestimate, with a peak value near or just above Active most likely.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	30	40	50	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM showing a rising trend, but with the peak on Days 2 and 3 likely to be too high.



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